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(54) ULTRA-THIN FILM  
LAMINATE

(57) Abstract:

**PURPOSE:** To improve the wear resistance and oxidation resistance of the surface of a substrate by alternately repetitively laminating thin films of two kinds of Ti-Al-N compds. varying in compsn. on the surface of the substrate.

**CONSTITUTION:** The thin film 3 which consists of carbides, nitride and carbonitrides of group IVa, Va and VIa metals in periodic table and has a thickness of 0.05 to 5 $\mu$ m is formed by an ion plating method by a vacuum arc discharge on the surface of the hard base material 2, such as cutting tip, drill or end mill, consisting of a WC-base sintered hard way, cermet, ceramics or high-speed steel, Two kinds of the compds. A, B expressed by  $Ti_xAl_{1-x}N$  (where  $0 \leq x < 0.5$ ) and  $Ti_yAl_{1-y}N$

(where  $0.5 < y \leq 1$ ) are alternately laminated in many layers on the surface of the thin-film layer 3 by setting the sum  $\lambda$  of the thickness  $t_1$ ,  $t_2$  of these compds. as a repetitive lamination period of 0.5 to 20nm. The thin films 1 having the total thickness of 0.5 to 10 $\mu$ m are thus formed. The wear resistance and oxidation resistance of the substrate 1 are greatly improved by the alternately laminated thin films of the Ti-Al-N alloy.

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